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ABSTRACT

Interactive closed circuit classroom television systems were installed in two special education classrooms to evaluate their impact on learning experiences of severely visually impaired elementary students. During a 3 year experimental period data were collected from approximately 14 students measuring achievement, visual motor integration, visual memory, and relevant social psychological dimensions (self esteem, social distance from students and teachers, and attachment to peers). Outcomes were examined within and between Ss in analyses assessing extent and pattern of change over time. Results indicated significant improvements across measurement areas. Achievement scores approximated grade normal by the final year, suggesting that the experimental system provided educational opportunities comparable to those experienced by the fully sighted. (Author/SBH)

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TELEVISION-MEDIATED EDUCATION FOR THE VISUALLY IMPAIRED: A LONGITUDINAL INVESTIGATION

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Interactive closed circuit classroom television systems were installed in two special education classrooms to evaluate their impact on learning experiences of severely visually impaired students. During a three-year experimental period data were collected from approximately 14 elementary students measuring achievement, visual-motor integration, visual memory and relevant social psychological dimensions. Outcomes were examined within and between subjects in analyses assessing extent and pattern of change over time. Results indicated significant improvements across measurement areas. Achievement scores approximated grade normal by the final year, suggesting that the experimental system provided educational opportunities comparable to those experienced by the fully sighted.

TELEVISION-MEDIATED EDUCATION FOR THE VISUALLY IMPAIRED: A LONGITUDINAL INVESTIGATION

by

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Visual classroom environments can be created for severely visually impaired students through the medium of interactive classroom television systems that take advantage of TV's magnification, contrast, and brightness capabilities. More precisely, an interactive classroom television system (ICTS) is a multicamera, multimonitor closed circuit TV system linking a series of student desks, a teacher's desk, and a room-viewing camera. Figure 1 shows a 9-camera, 8-monitor system in an elementary school classroom. Such a system permits teachers and their partially sighted students to be in continuous two-way visual communication with one another. Moreover, it allows partially sighted students to function visually in classroom situations that are closely akin to those experienced by their fully sighted peers; that is, they can read ordinary printed matter, look at pictures, write with pen or pencil, do workbook problems, correct each other's papers, see the clock on the wall, draw or paint. Thus, an ICTS constitutes a complex visual aid that enables severely impaired students to make the fullest possible use of their residual vision.

This paper presents the results of a three-year demonstration project whose aim was to evaluate the effects of an ICTS on the learning experiences of partially sighted elementary school students in special education programs in two Southern California school districts. The assumption underlying the research was that even severely impaired students have residual visual capabilities which, given an appropriate aid, can be put to use to maximize learning and provide educational outcomes comparable to those of the fully sighted.*

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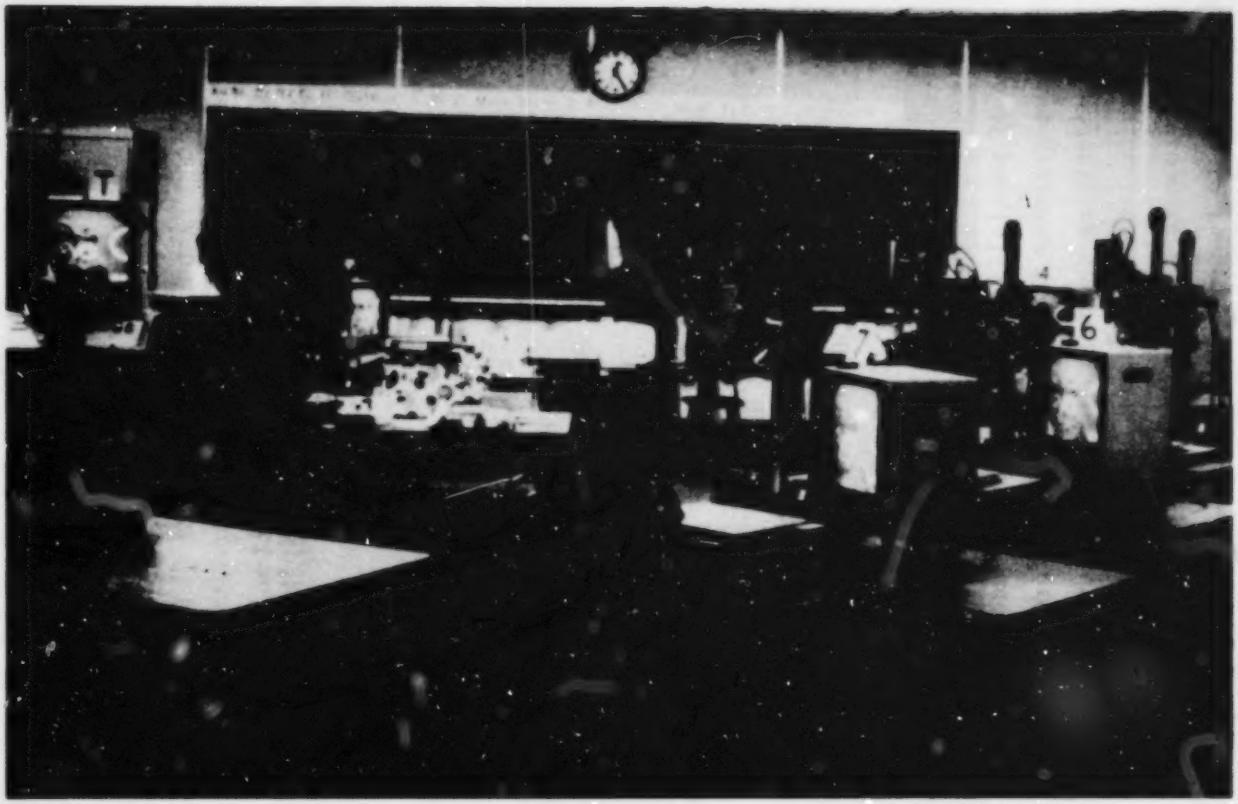

Fig. 1--Eight-station Interactive Classroom Television System

Subjects and Procedures

Students in the two participating special education programs were eligible to take part in the ICTS project: a) if they were partially sighted, i.e., if acuity in the better eye even with corrective lenses did not exceed 20/70 but was better than light perception or projection alone; b) if, given multiple impairments, nonvisual handicaps did not seriously interfere with use of TV controls; and c) if they were nominally assigned to grade levels one through six for enrollment purposes, regardless of actual performance level. A total of 21 students met these criteria and became subjects during the three-year research project; more than 80 percent were legally blind. Table 1 presents information about all participating subjects, including acuity, sex, ethnicity, measured IQ, nominal grade level, and age.

Teachers in the participating special education programs were trained to operate both student stations and the master control console. As Figure 2 shows, a single student station has the following features: a down-pointing TV camera equipped with a 5-to-1 zoom lens that has close-up capability; a TV monitor mounted at eye level; a light source for illuminating reading and writing materials; and an X-Y platform, a moveable work surface that has margin stops in the "X" or left-right direction and friction control in the "Y" or line-to-line direction. The X-Y platform supports reading and writing materials below the student's station camera. An ICTS classroom could have any number of stations, depending on the anticipated number of students. For the research reported here, Site I had four individual stations and Site II, eight.

In addition to individual stations, each ICTS classroom has a control console, typically located at or near a teacher's desk. The control console permits teachers to present on any one of the system's station monitors, independently of what is presented on any other monitor: 1) a full-screen image of the output from any one of the system's cameras or from a videotape recorder; 2) a horizontally split image of the output from any two of these sources; or 3) a full-screen superposition of the output from any two sources. With these system capabilities, for instance, partially sighted students can work

Table 1

ICTS SUBJECTS

Subject	Acuity[a]	Sex	Ethnicity	IQ[d]	Project Year: First Nominal Grade Level	First Age In Months 10/75	Second Nominal Grade Level	Second Age In Months 10/76	Third Nominal Grade Level	Third Age In Months 10/77
Site I										
101	20/200	F	Black	74	6	132				
102	20/80	M	Black	64	5	128	6	140		
103	20/200	M	White	124	3	103	4	115	5	127
104	20/400	M	White	137	4	111	5	123	6	135
105[b]	20/240	M	White	109	1	73				
106[b]		M	White				K	...		
107	20/400	M	Black	109					K	66
Site II										
201[b]	20/400	F	Black	97	3	95	4	107	5	119
202[b]		F	White		4	...				
203	20/80	F	White	73	6	141	6[c]	153		
204	20/640	M	Chicano	75	K	75	1	87	2	99
205	20/160	M	White	111	1	72				
206	20/100	M	Chicano	79	K	66				
207	20/120	M	Chicano	114	K	58	K	70	1	82
208[b]	20/200	M	Black	87	K	61	1	73	2	85
209[b]		F	Black		3	...				
210	20/200	M	White	82	6	134	6[c]	146	6[c]	158
211	20/700	M	Chicano	100	1		1	79		
212	20/200	M	Black	99			K	75	1	87
213	20/120	F	Chicano	119			4	111	5	123
214	20/120	M	White	67			2	92		
215	20/120	M	Black	82			6	133	6[c]	145
216	20/360	F	Chicano	112					4	112
217	20/320	F	Chicano	92					4	111

[a]Field measurements have been omitted for lack of standardized ways of representing their perimetry; however, many students had severely impaired fields and some were classified as legally blind on that basis as well as acuity loss.

[b]Subjects were accepted into the study, but either moved or were transferred prior to collecting one full year of data.

[c]Subjects had achieved neither academic nor social maturity for matriculation.

[d]Measured by school psychologists using the WISC-R, WIPPSI, or Slosson.

Fig. 2--An ICTS student station

individually on their own materials or all read what is displayed from one camera; they can write solutions to arithmetic problems displayed on the board without having to recopy the problems themselves; and they can fill in the blanks on a superimposed workbook page or correct one another's papers. The system's room-viewing camera is mounted on the ceiling of the classroom and is run remotely. It can pan and tilt, and so can bring virtually any part of the classroom within the view of its 10-to-1 zoom lens. The smaller Site I system was built first, to establish the feasibility of an ICTS classroom (that system is described in detail in Genensky et al., June 1974). Successful operation of that system led to the construction of the larger Site II system (described fully in Genensky et al., 1977), along with funds for evaluating the educational effects of ICTS classrooms.

When the evaluation of the ICTS as a learning mediator began in fall 1975 concurrently with the completion of the Site II system, the Site I classroom had already had a full year's experience with television-mediated education. For purposes of formal evaluation, however, the following conditions were established for both sites. Teachers were required to have their students spend two hours per day using the ICTS for academic instruction in group as well as individualized activities. In addition, they could use the ICTS as much or as little as they pleased in nonacademic activities such as music, art, and drama. Teachers were encouraged to employ ordinary grade-appropriate curricular materials (e.g., tests, work sheets, paper-and-pencil games); however, actual choices of materials and lesson plans were entirely their own. It was hypothesized that such an ICTS program would significantly improve the learning experiences of the severely visually impaired subjects in the demonstration, and that improvements would be more manifest the longer the subjects participated in television-mediated instruction.

Data Collection and Analysis

Program outcomes for subjects were conceptualized in terms of four areas. Of primary importance was the impact of the ICTS on *academic achievement* in basic elementary school skills. Basic skills, for the purpose of this evaluation, were restricted to reading and mathematics achievement as measured by appropriate subtests of the Comprehensive Test of Basic Skills (CTBS). A second area of concern was the relationship of the ICTS to *visually dependent perceptual-motor skills* such as visual motor integration (assessed by the Developmental Test of Visual Motor Integration, or VMI) and visual memory (assessed by the visual sequential subtest of the Illinois Test of Psycholinguistic Abilities, or ITPA). For the partially sighted students making use of residual vision by means of an ICTS, these processes are important mediators of information encoding and decoding, and thus could have a substantial influence on learning. Third, the project sought to determine what effect, if any, the ICTS had on *self and social attitudes* (e.g., self-esteem and peer affiliation) thought to be significant in students' school experiences. For this purpose we employed both a

verbal self-report instrument (the Self Observation Scales, or SOS) and a symbol manipulation task using geometric shapes and relationships to stand for self and social constructs (the Self Social Constructs Test, or SSCT). In addition we tried to assess facial affect decoding and encoding as a subarea of psychosocial function. It was supposed that for partially sighted students social competence is in part visually mediated--that the ability accurately to perceive and respond to social stimuli is an important part of psychosocial development which most likely involves successful affect encoding and decoding. The latter was measured by the Interperson Perception Test (IPPT), while the former was measured in terms of scores on a facial expression production task devised by Ekman and Friesen (1975).

All measures were administered on a pre-post basis during the first year in which a student participated in the project. In succeeding years, only psychosocial data were collected on a pre-post basis; for other assessments, data from the previous spring served as premeasures with new data collection occurring only once at the end of the academic year. Where possible, scores were represented in terms of age- or grade-level equivalents and/or their distance from an age- or grade-normal outcome. Because the number of subjects was small and because there was no reason to expect normally distributed data, within-year outcomes were investigated using nonparametric analyses relying only on ordinal properties of scores. Examining pre-to-post changes was of primary interest. For this purpose, Wilcoxen matched-pairs signed-ranks tests (within-subjects) were used. Between-subjects comparisons exploring outcome differences as a function of site or age group (grades one to three versus four to six) were evaluated with the Mann Whitney U statistic.

Longitudinal analyses were undertaken on data from subjects who had participated in the project for at least two years, in order to investigate changes within subjects over time. For this purpose, data were grouped on the basis of "participation year." Defining participation years I and II as a subject's first and second year of enrollment in the project (independently of calendar year) generated a sufficiently large sample for repeated measures analyses of variance. Longitudinal

analyses employ both time of measurement (pre-to-post) and participation year (I and II) as repeated independent factors;* where appropriate, such analyses also treat age- or grade-level as crossed independent factors. Finally, attrition studies were conducted to determine whether performance changes established by longitudinal analyses should be attributed to the experimental intervention or to selective disenrollment in the project. For this purpose, subjects were divided into two subsamples: those for whom two or more participation years of data were available, and those who participated one year only. All outcomes examined longitudinally were also explored on a between-subjects basis to determine whether any evaluation variables significantly differentiated the attrition group from the subjects who remained in the project.

Results

Discussion of results is organized according to the order in which outcome areas were described above. Achievement evaluation** results over the three years of the demonstration generated the following conclusions. First, pre-post comparisons showed ICTS subjects improving significantly in both reading and mathematics each year, as expected. Further, at the end of the first year the following pattern of gains was evident: Older students were significantly further from grade normal in both reading and mathematics than were younger students, an

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*Instead of using *participation year* and *pre-post change* as two two-level repeated factors, it would be just as appropriate analytically to treat *time* as a single repeated three- or four-level factor. Our choice of the former procedure rested on two considerations. First, the decision to include or not include a fall measure collected some four months after a spring measure with no school experience intervening raises several issues that this procedure avoids (e.g., Hammond, 1979); these issues are further confounded in the case of students who changed achievement test levels (Barker and Pelavin, 1976). We thought that the chosen procedure would underscore for readers the fact that participation year represents different calendar years (and thus differing pre- and post-measurement times) for some students.

**It should be noted that each year several younger students were unable to perform at the first-grade level and had to be tested with pre-academic instruments. For this purpose we used subtests from the ETS CIRCUS battery. Results are given in T. K. Bikson et al., 1979.

outcome to be expected given the cumulative nature of educational deficits; and all students performed significantly better in mathematics (i.e., scored closer to grade normal) than in reading (see Table 2). We inferred that relative superiority of mathematics scores was attributable to the fact that doing computations requires less scanning than does reading. However, students' scores were systematically inferior to grade normal in both skill areas at the end of the first year. The second year's data revealed a contrasting gains pattern: Substantially greater improvement occurred in reading than in mathematics, so that no statistically significant differences remained between scores in the two skill areas; apparently a second year of ICTS experience enabled students to learn the visual scanning skills requisite for advances in reading achievement (see Table 3). Finally, by the end of the third year of the demonstration, students' achievement scores in both skill areas were not significantly different from grade normal (see Table 4).

Tables 5 and 6 present cell means (N = 17) and values of F with related significance levels for examined sources of variation in reading and mathematics scores studied longitudinally. Table 5 treats reading results as obtained grade equivalent scores (upper half) and as distances between obtained and grade normal scores (lower half); Table 6 is organized similarly. As the analysis summary indicates, reading scores in grade equivalents exhibit a highly significant main effect for pre-post change, a result anticipated on the basis of within-year findings. The average gain was 4.7 months in participation year I and 1 year 6 months in participation year II, or an average gain of 1 year 2.2 months in reading equivalents per year among two-year students. While participation year itself yields no main effect, the change-by-year interaction terms are significant; reading gains are substantially greater in a student's second year, a finding that corroborates within-year conclusions. The analysis of distances between obtained and grade normal reading scores, in contrast, finds no source of variation to significantly influence results. It is interesting to note that while lower-level students' scores tend to be less distant from grade normal (in part reflecting floor effects), it

Table 2

CTBS SCORES, 1975-1976

Subject	Grade Normal	Reading				Mathematics				Post-test: Reading - Mathematics
		Post-test Score	Distance from Grade Normal	Pre-test Score	Pre-Post Change	Post-test Score	Distance from Grade Normal	Pre-test Score	Pre-Post Change	
Site I										
101	6.9	5.4	-1.5	4.6	+0.8	4.9	-2.0	5.2	-0.3	+0.5
102	5.9	1.8	-4.4	1.5	+0.3	3.7	-2.2	2.9	+0.8	-1.9
103	3.9	3.3	-0.6	3.6	-0.3	4.0	+0.1	3.8	+0.2	-0.7
104	4.9	5.2	+0.3	5.8	-0.6	5.9	+1.0	4.4	+1.5	-0.7
105	1.9	1.5	-0.4	0.6	+0.9	2.1	+0.2	0.5	+1.6	-0.6
Site II										
201	3.9	3.0	-0.9	2.3	+0.7	2.5	-1.4	2.5	0	+0.5
203	6.9	3.1	-3.8	2.3	+0.8	3.3	-3.6	3.2	+0.1	-0.2
205	1.9	1.8	-0.1	1.0[a]	+0.8	2.7	+0.8	1.0[a]	+1.7	-0.9
210	6.9	2.3	-4.6	2.3	0	3.6	-3.3	1.6	+2.0	-1.3
Means			-1.8		+0.4		-1.24		+0.8	-0.6

[a]Theoretical beginning first grade score; this student was untestable in the fall on the lowest level of the CTBS.

Table 3

CTBS SCORES, 1976-1977

Subject	Grade Normal	Reading				Mathematics				Post-test: Reading - Mathematics
		Post-test Score	Distance from Grade Normal	Pre-test Score	Pre-Post Change	Post-test Score	Distance from Grade Normal	Pre-test Score	Pre-Post Change	
Site I										
102	6.9	2.1	-4.8	1.8	+0.3	4.0	-2.9	3.7	+0.3	-1.9
103	4.9	5.1	+0.2	3.3	+1.8	5.8	+0.9	4.0	+1.8	-0.7
104	5.9	6.1	+0.4	5.2	+0.9	6.7	+0.8	5.9	+0.8	-0.4
Site II										
201	4.9	5.1	+0.2	3.0	+2.1	3.4	-1.5	2.5	+0.9	+1.7
203	7.9	4.8	-3.1	3.1	+1.7	3.0	-4.9	3.3	-0.3	+1.8
210	7.9	3.5	-4.4	2.3	+1.2	4.4	-3.5	3.6	+0.8	-0.9
211	1.9	1.7	-0.2	0.1	+1.6	1.3	-0.6	0.1	+1.2	+0.4
213	4.9	5.7	+0.8	5.5	+0.2	5.1	+0.2	4.0	+1.1	+0.6
214	2.9	1.9	-1.0	1.2	+0.7	1.8	-1.1	0.1	+1.7	+0.1
215	6.9	4.9	-2.0	2.2	+2.7	3.3	-3.6	3.6	-0.3	+1.6
Means			-1.39		+1.32		-1.62		+0.8	+0.2

Table 4

CTBS SCORES, 1977-1978

Subject	Grade Normal	Reading				Mathematics				Post-test: Reading - Mathematics
		Post-test Score	Distance from Grade Normal	Pre-test Score	Pre-Post Change	Post-test Score	Distance from Grade Normal	Pre-test Score	Pre-Post Change	
Site I										
103	5.9	5.4	-0.5	5.1	+0.3	7.1	+1.2	5.8	+1.3	-1.7
104	6.9	7.8	+0.9	6.3	+1.5	6.5	-0.4	6.7	+0.9	+1.3
Site II										
201	5.9	6.9	+0.11	5.1	+1.8	5.7	-0.3	3.4	+2.3	+1.2
204	3.9	0.3	-3.7	0.2	+0.1	0.6	-3.4	0.1	+0.5	-0.3
207	2.9	1.9	-1.1	1.7	+0.2	4.5	+1.7	3.2	+1.3	-2.6
208	2.9	1.6	-1.4	0.1	+1.5	1.6	-1.4	1.2	+0.4	+0.0
210	8.9	5.0	-3.10	3.5	+1.5	5.0	-3.1	4.4	+0.6	+0.0
212	2.9	1.9	-1.1	1.7	+0.2	2.9	-0.1	1.5	+1.4	-1.0
213	5.9	10.0	+4.2	5.7	+4.3	7.0	+1.2	5.1	+1.9	+3.0
215	7.9	6.3	-1.7	4.9	+1.4	5.6	-2.4	3.3	+2.3	+0.7
216	4.9	7.1	-2.3	4.3	+2.8	6.5	+1.7	5.2	+1.3	+0.6
217	4.9	7.1	-2.3	3.4	+3.7	5.7	+0.9	2.8	+2.9	+1.4
Means			-0.2		+1.6		-0.4		+1.3	+0.2

Table 5

LONGITUDINAL READING SCORE ANALYSIS

CTBS READING SCORES (grade equivalents)

Change	Participation Year I	Participation Year II
Pre	3.2	3.4
Post	3.7	5.0

Source	F	p
Participation Year	.91	n.s.
Change	14.29	.002
Year X Change	4.05	.06

DISTANCE BETWEEN OBTAINED AND GRADE NORMAL READING SCORES

Change	Participation Year I		Participation Year II	
	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	-0.2	-2.0	-0.4	-2.1
Post	-0.8	-2.2	-1.0	-1.1

Source	F	p
Participation Year	.01	n.s.
Change	.12	n.s.
Grade Level	.64	n.s.
Year X Change	.61	n.s.
Year X Grade	.06	n.s.
Change	1.62	n.s.

Table 6

LONGITUDINAL MATHEMATICS SCORE ANALYSIS

CTBS MATHEMATICS SCORES
(grade equivalents)

Change	Participation Year I	Participation Year II
Pre	3.2	3.7
Post	3.9	4.8

Source	F	p
Participation Year	1.15	n.s.
Change	19.87	< .001
Year X Change	1.14	n.s.

DISTANCE BETWEEN OBTAINED AND
GRADE NORMAL MATHEMATICS SCORES

Change	Participation Year I		Participation Year II	
	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	-0.05	-2.0	-0.6	-1.8
Post	-0.6	-1.9	0	-1.5

Source	F	p
Participation Year	.01	n.s.
Change	.04	n.s.
Grade Level	1.40	n.s.
Year X Change	1.79	n.s.
Year X Grade	.01	n.s.
Change X Grade	.15	n.s.

is higher level students whose scores show a net decrease in distance from grade normal over two participation years. Comparable findings come from longitudinal analyses of mathematics scores. As Table 6 indicates, mathematics scores exhibit strong main effects for pre-to-post change across two participation years. Average gain in grade equivalents was 6.8 months in the first participation year and 1 year 1 month in the second, for an average nine-month gain per 10-month school year. Here, however, the change-by-year interaction is not statistically significant. The analysis of distances between obtained and grade normal mathematics scores, like that for reading scores, shows no significant source of variation. It is interesting, nevertheless, to note the similar pattern of mean discrepancies in relation to grade level. That is, while grade level does not yield a main effect, the average discrepancy tends to be smaller for younger than for older students, while older students show more systematic decreases in discrepancy during the two years.

Attrition studies of reading and mathematics scores indicated that sustained academic advances could not be attributed to selective dropout. In each outcome area, analyses yielded overall rates of change comparable to those provided by the longitudinal study and failed to yield either main effects or significant cell contrasts by group. However, the change-by-group interaction term approached significance in both reading ($F = 4.03$, $p = .07$) and mathematics ($F = 2.86$, $p = .12$); interestingly, it was the attrition group that tended to improve more rapidly during the first participation year. Consequently, the pattern of gains in basic academic skills established in longitudinal analyses, if it is biased, most likely overrepresents slower learners.

The investigation of the two visually dependent perceptual-motor skill areas yielded an interesting and related pattern of results. With respect to visual-motor integration, students' scores showed a significant increase in the first year although at post-test they remained substantially behind developmental age norms. Visual sequential memory scores were higher, on average, by the end of the first year as well but not by a statistically significant margin (see Table 7). In

Table 7

VISUALLY DEPENDENT SKILLS, 1975-1976

Subject	Age (Years-months)	VMI				ITPA[a]				Post-test: VMI-ITPA
		Post-test Score	Distance from Age Normal	Pre-test Score	Pre-Post Change	Post-test Score	Distance from Age Normal	Pre-test Score	Pre-Post Change	
Site I										
101	11-7	8-8	-35	7-2	+18	5-4	-75			+40
102	11-3	6-10	-53	6-10	0	5-7	-68			+15
103	9-2	7-10	-16	6-5	+17	10-5[b]	+15			-31
104	9-10	10-11	+13	7-10	+37	10-5[b]	+ 7			+ 6
105	6-8	5-7	-13	5-0	+ 7	6-10	+ 2			-15
Site II										
201	8-6	6-10	-20	5-10	+12	6-6	-24	8-4	-22	+ 4
203	12-4	9-6	-34	5-6	+48	6-6	-70	7-10	-16	+36
204	6-10	4-1	-33	4-9	- 8	5-7	-15	4-4	+15	-18
205	6-7	7-4	+9	6-5	+11	6-2	- 5	6-2	0	+14
206	6-1	4-9	-16	4-6	+ 3	10-5[b]	+52	4-10	+67	+68
207	5-5	5-3	-2	4-4	+11	5-7	+ 2	6-2	- 7	- 4
208	5-8	4-9	-11	4-4	+ 5	4-10	-10	3-1	+21	- 1
210	11-9	7-10	-47	7-4	+ 6	5-10	-.71	5-7	+ 3	+24
Means			-20		+13		-20		+ 8	

[a] ITPA was not administered to Madison subjects in fall 1976.

[b] Ceiling scores.

contrast, the second year's data manifested just the opposite sorts of results: VMI scores tended in general to increase but not systematically; ITPA visual sequential memory scores, on the other hand, showed strong and significant improvements. It seemed likely that visual-motor coordination increased as students learned to use the ICTS, during the first year of the demonstration. But scanning, as we have seen, was more difficult and apparently required a longer learning period. Thus, visual sequential memory scores (partly dependent on scanning skills) did not evidence significant positive change until the second year, during which reading (also scan-dependent) improved as well (see Table 8). These conjectures were supported by examining inter-correlations among achievement and visually dependent skill scores. While ITPA scores were associated with mathematics achievement, they were much more closely correlated with reading achievement. The third year's outcomes showed further (and significant) gains in VMI scores, with subjects topping out on the ITPA subtest (see Table 9).

Longitudinal results are given in Tables 10 and 11, which present cell means and values of F with related significance levels for independent factors expected to influence visual-motor integration and visual sequential memory (N = 17); scores represent age equivalents in months. The analysis summary in Table 10 (upper half) indicates a highly significant main effect for overall rate of pre-post change in visual-motor integration, an encouraging result since fall-to-spring gains reached statistical significance during only two of the three project years. The average gain in month equivalents was 12.1 for participation year I and 14.2 for participation year II, or an average gain of 13.2 months in developmental equivalents per year in visual-motor integration among two-year students. Dependent measures in the lower half of Table 10 represent distance of obtained scores from age-normal scores in terms of months. Here the rate of change approaches significance, suggesting that students were making strong, stable progress toward developmentally normal performance in visual-motor integration. In addition, age level significantly influenced scores, with older students beginning and remaining much further behind developmental

Table 8

VISUALLY DEPENDENT SKILLS, 1976-1977

Subject	Age (Years-months)	VMI				ITPA			
		Post-test Score	Distance from Age Normal	Pre-test Score	Pre-Post Change	Post-test Score	Distance from Age Normal	Pre-test Score	Pre-Post Change
Site I									
102	12-3	8-7	-44	6-10	+21	5-10	-77	5-7	+ 3
103	10-2	6-5	-45	7-10	-17	10-5	+ 3	10-5+[a]	0
104	10-10	11-9	+11	10-11	+10	10-5+[a]	0	10-5+[a]	0
Site II									
201	9-6	9-6	0	6-7	+35	9-6	+ 3	7-3	+30
203	13-4	7-11	-65	7-4	+ 7	6-10	-66	7-10	-12
204	7-10	4-9	-37	4-4	+ 5	6-2	-20	5-7	+ 7
207	6-5	5-3	-14	5-3	0	10-5	+48	6-2	+51
208	6-8	6-10	+ 2	5-7	+15	6-2	- 6	4-4	+22
210	12-9	9-4	-41	6-5	+35	7-10	-47	7-3	+ 7
211	7-2	5-0	-26	4-4	+ 8	5-10	-16	4-7	+15
212	6-10	5-0	-22	4-9	+ 3	6-6	- 4	5-7	+11
213	9-10	9-6	- 4	6-7	+35	10-5+	+ 7	6-10	+43
214	8-3	5-0	-39	5-7	- 7	5-10	-29	6-6	- 8
215	11-8	6-10	-58	8-7	-21	10-5+[a]	0	9-9	+ 8
Means			-27		+ 9		-15		+13

[a]Ceiling score.

Table 9

VISUALLY DEPENDENT SKILLS, 1977-1978

Subject	Age (Years months)	VMI				ITPA			
		Post-test Score	Distance from Age Normal	Pre-test Score	Pre-Post Change	Post-test Score	Distance from Age Normal	Pre-test Score	Pre-Post Change
Site I									
103	11-2	9-4	-22	6-5	+35	10-5+[a]	0	10-5	0
104	11-10	12-8	+10	11-9	+11	10-5+[a]	0	10-5+[a]	0
107	6-1	4-9	-16	4-1	+ 8	3-4	-33	3-7	- 3
Site II									
201	10-6	11-1	+ 7	9-6	+19	10-5+	0	9-9	+ 8
204	8-10	5-7	-39	4-9	+10	5-10	-36	6-2	- 4
207	7-5	5-7	-22	5-3	+ 4	9-9	+29	10-5	- 8
208	7-8	7-4	- 4	6-10	+ 6	9-9	+25	6-2	+43
210	13-9	6-10	-83	9-4	-30	6-10	-83	7-10	-12
212	7-10	6-0	-22	5-0	+12	6-6	-16	6-6	0
213	10-10	9-6	-16	9-6	0	10-5[a]	0	10-5[a]	0
215	12-8	9-4	-40	6-10	+30	7-3	-65	10-5[a]	-38
216	9-11	6-7	-40	7-2	- 7	10-5[a]	+ 6	10-5	0
217	9-10	7-11	-23	9-6	-19	10-5[a]	+ 7	10-5[a]	0
Means			-24		+ 6		-13		(b)

[a]Ceiling score.

[b]The frequency of positive nonscoreable changes (i.e., changes beyond ceiling) renders mean change infeasible to calculate for the final project year.

Table 10

LONGITUDINAL VISUAL MOTOR INTEGRATION STUDY

VMI SCORES (age equivalents in months)

Change	Participation Year I	Participation Year II
Pre	73.1	82.4
Post	85.2	96.6

Source	F	p
Participation Year	1.46	n.s.
Change	14.67	< .001
Year X Change	.09	n.s.

DISTANCE BETWEEN OBTAINED AND AGE NORMAL VMI SCORES

Change	Participation Year I		Participation Year II	
	Age Level		Age Level	
	Lower	Higher	Lower	Higher
Pre	-17.0	-41.0	-20.6	-39.6
Post	-17.3	-30.5	-14.2	-31.9

Source	F	p
Participation Year	.00	n.s.
Change	2.98	.10
Grade Level	5.27	.03
Year X Change	.006	n.s.
Year X Age	.00	n.s.
Change X Age	.75	n.s.

Table 11

LONGITUDINAL VISUAL MEMORY STUDY

ITPA SCORES (age equivalents in months)

Change	Participation Year I	Participation Year II
Pre	76.67	92.17
Post	82.89	98.0

Source	F	P
Participation Year	2.36	.14
Change	1.69	n.s.
Year X Change	.002	n.s.

DISTANCE BETWEEN OBTAINED AND AGE NORMAL ITPA SCORES

Change	Participation Year I		Participation Year II	
	Age Level		Age Level	
	Lower	Higher	Lower	Higher
Pre	-6.8	-39.8	-13.2	-28.1
Post	-10.2	-37.3	-1.8	-40.9

Source	F	P
Participation Year	.08	n.s.
Change	.01	n.s.
Grade Level	6.31	.02
Year X Change	1.67	n.s.
Year X Age	.00	n.s.
Change X Age	1.67	n.s.

norms than younger students.* Longitudinal analysis of VMI scores, then, supported conclusions drawn from within-year data: While students showed improvement across project years, measured both as gains in developmental months and as decreases in distance from age-normal visual-motor functioning, they were unable to eliminate the discrepancy between obtained and developmentally expected scores, with older students being at the most severe disadvantage.

Contrasting findings come from the analyses of visual sequential memory scores. As Table 11 (upper half) indicates, none of the examined sources of variation had a major effect on visual sequential memory. Participation year is the strongest independent factor and approaches statistical significance, suggesting that the second year of ICTS experience was important in promoting visual sequential skills. Outcomes at the end of the second participation year averaged 19.1 months higher than outcomes attained at post-test time 12 months earlier; these findings tend to corroborate interpretations of within-year studies (where only the second project year produced significant gains) and are strengthened by results of the longitudinal investigation of reading and mathematics scores. The examination of distances between obtained and age-normal scores is summarized in the lower half of Table 11 where only one main effect is evident: Older students' visual sequential memory performance was substantially more discrepant with developmental norms than was the performance of younger students. The cell means suggest that gains on age norms are found primarily among the younger students, with older students neither losing ground nor advancing. Consequently, the fact that by the end of the project no significant differences existed between obtained and grade-normal scores was primarily a function of the scores of younger students. These results, together with the longitudinal analysis of VMI scores, suggest that it may be more difficult for students to overcome deficits in perceptual motor skills related to visual impairment than to overcome related achievement deficits. If so, it could be supposed that while perceptual

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*Age rather than grade level is used as a grouping factor for analyses of perceptual-motor skill scores since the instruments are normed by age in months.

motor skills surely facilitate transfer of academic information and while some level of skill acquisition is requisite for reading and mathematics achievement, age-normal perceptual motor function is not necessary to grade-normal achievement.

Attrition analyses of VMI and ITPA scores leave these conclusions unchanged. That is, inclusion of the attrition group corroborated an effect for pre-post change in VMI scores and the absence of such an effect in ITPA scores. In neither case did the influence of group or group-by-change interaction approach significance. Interpretation of project results in the area of perceptual-motor skills, then, does not involve selective attrition factors.

The third evaluation area, self and social attitudes, seemed most recalcitrant to change. Two different measurement methods were chosen to assess a set of attitudes thought to be relevant to school success. The experimentally developed Self Social Constructs Test (SSCT), a non-verbal instrument that makes use of spatial symbols and their arrangement to represent self and social schemata, was employed to assess four constructs: self-esteem, social distance from teachers and peers, and scope of peer attachment. The second attitude instrument employed, the nationally normed Self Observation Scales (SOS), is a set of verbal yes-no items designed to assess self-acceptance, social maturity, school affiliation, and self-security. Results for the two instruments on a within-year basis are presented in Tables 12 through 14. As is evident, school-relevant self and social attitudes did not show positive difference scores over the three years generally commensurate with achievement and related visual skill gains. Specifically, the first year's data yielded no overall significant gains on any psychosocial measure except for social maturity (SOS), an outcome not specifically associated with the demonstration and probably reflective of normal social development with increasing school experience (Table 12). Somewhat more encouraging results were manifest in the second year's data (Table 13), which yielded significant positive changes in self-esteem and peer attachment or affiliation scores (SOS, SSCT) generated by two quite different measurement methods. However, by the third year, only small and inconsistent changes appeared (Table 14): Social distance from peers

Table 12

PSYCHOSOCIAL OUTCOMES, 1975-1976

SELF SOCIAL CONSTRUCTS TEST, 1975-1976

Subject	Self-Esteem			Social Distance from Students			Social Distance from Teachers			Attachment to Peers		
	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change[a]	Post-test Score	Pre-test Score	Pre-Post Change[a]	Post-test Score	Pre-test Score	Pre-Post Change
Site I												
101	39	38	+ 1	2	7	-5	2	2	0	24	24	0
102	24	34	-10	7	10	-3	6	3	+ 3	23	18	+ 5
103	26	27	- 1	9	7	+2	12	4	+ 8	18	21	- 3
104	29	28	+ 1	2	5	-3	2	4	+ 2	24	24	0
105	20	23	- 3	8	6	+2	11	10	+ 1	21	23	- 2
Site II												
201	28	20	+ 8	10	4	+6	7	9	- 2	21	14	+ 7
203	39	27	+12	2	5	-3	2	8	- 6	19	5	+14
204	23	33	-10	6	2	+4	5	2	+ 3	2	13	-11
205	34	24	+10	7	2	+5	2	2	0	23	3	+20
206	27	37	-10	7	9	-2	6	7	- 1	7	15	- 8
207	34	32	+ 2	3	4	-1	12	2	+10	15	14	+ 1
208	22	23	- 1	2	6	-4	2	5	- 3	16	12	+ 4
210	45	29	+16	2	9	+7	12	10	+ 2	19	18	+ 1
Means	30	29	+ 1.2	5	6	+0.4	6	5	+ 1.3	18	16	+ 2.2
Range	(8-48)			(2-12)			(2-12)			(0-24)		

[a]Negative changes are representative of *decreased* social distance (i.e., favorable change).

SELF-OBSERVATION SCALES, 1975-1976[a]

Subject	Self-Acceptance			Social Maturity			School Affiliation			Self-Security		
	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change
Site I												
101	65	61	+ 1	53	54	- 1	59	58	+ 1	67	61	+ 6
102	54	60	- 6	54	50	+ 4	59	54	+ 5	46	55	- 9
103	56	63	- 7	55	56	- 1	55	58	- 3	65	66	- 1
104	65	64	+ 1	57	56	+ 1	59	58	+ 1	67	66	+ 1
105	64	48	+16	56	53	+ 3	57	33	+24	67	67	0
Site II												
201	57	52	+ 5	56	57	- 1	31	44	-13	63	59	+ 4
203	60	59	+ 1	58	60	- 2	61	59	+ 2	57	57	0
204	55	56	- 1	26	24	+ 2	52	56	- 4	25	22	+ 3
205	55	38	+17	55	49	+ 6	43	52	- 9	58	46	+12
206	43	41	+ 2	30	24	+ 6	55	43	+12	34	37	- 3
207	40	42	- 2	30	29	+ 1	28	41	-13	46	50	- 4
208	53	53	0	39	37	+ 2	46	60	-14	45	48	- 3
210	51	43	+ 8	51	41	+10	46	51	- 5	52	45	+ 7
Means	55	52	+ 2.7	48	45	+ 2.3	50	51	- 1.2	53	52	+ 1.0

[a]T-scores: scales are standardized with $\bar{x}$ = 50 and s.d. = 10.

Table 13

PSYCHOSOCIAL OUTCOMES, 1976-1977

SELF SOCIAL CONSTRUCTS TEST, 1976-1977

Subject	Self-Esteem			Social Distance from Students			Social Distance from Teachers			Attachment to Peers		
	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change[a]	Post-test Score	Pre-test Score	Pre-Post Change[a]	Post-test Score	Pre-test Score	Pre-Post Change
Site I												
102	29	26	+ 3	2	4	- 2	6	5	+ 1	17	19	- 2
103	33	24	+ 9	4	7	- 3	6	7	- 1	5	12	- 7
104	31	16	+15	9	2	+ 7	2	2	0	24	24	0
Site II												
201	44	32	+12	2	6	- 4	2	12	-10	9	16	- 7
203	29	30	- 1	2	2	0	2	2	0	24	21	+ 3
204	24	41	-17	5	2	+ 3	8	2	+ 6	3	2	+ 1
207	36	36	0	2	2	0	3	2	+ 1	19	22	- 3
208	34	26	+ 8	2	2	0	2	2	0	24	24	0
210	34	31	+ 3	12	12	0	2	12	-10	22	19	+ 3
211	36	28	+ 8	2	2	0	2	5	- 3	24	6	+18
212	22	20	+ 2	6	5	+ 1	5	10	- 5	3	4	- 1
213	40	31	+ 9	7	8	- 1	12	9	+ 3	24	21	+ 3
214	48	38	+10	2	2	0	2	12	-10	19	9	+10
215	42	27	+15	2	4	- 2	2	2	0	24	24	0
Means	34	29	+ 5.4	4	4	- 0.07	4	6	- 2.0	17	16	+ 1.3
Range		(8-48)			(2-12)			(2-12)			(0-24)	

[a]Negative changes are representative of *decreased* social distance (i.e., favorable change).

SELF-OBSERVATION SCLAES, 1976-1977[a]

Subject	Self-Acceptance			Social Maturity			School Affiliation			Self-Security		
	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change
Site I												
102	60	54	+ 6	59	57	+ 2	60	56	+ 4	58	54	+ 4
103	62	43	+19	57	50	+ 7	43	30	+13	66	69	- 3
104	63	63	0	60	60	0	59	59	0	67	67	0
Site II												
201	58	58	0	51	52	- 1	24	30	- 6	70	71	- 1
203	59	61	- 2	58	48	+10	39	60	-21	55	50	+ 5
204	53	50	+ 3	44	24	+20	40	51	-11	55	30	+25
207	61	49	+12	38	38	0	32	46	-14	52	51	+ 1
208	55	56	- 1	24	27	- 3	51	47	+ 4	36	34	+ 2
210	60	54	+ 6	54	53	+ 1	43	27	+16	56	58	- 2
211	55	48	+ 7	33	28	+ 5	36	36	0	51	37	+14
212	58	49	+ 9	25	38	-13	38	43	- 5	47	60	-13
213	61	55	+ 6	56	54	+ 2	38	41	- 3	63	54	+ 9
214	57	56	+ 1	42	27	+15	50	56	- 6	53	52	+ 1
215	62	57	+ 5	59	49	+10	50	51	- 1	65	56	+ 9
Means	59	54	+ 5.1	47	44	+ 3.9	43	45	- 2.1	57	54	+ 3.6

[a]T-scores: scales are standardized with $\bar{x}$ = 50 and s.d. = 10.

Table 14

PSYCHOSOCIAL OUTCOMES, 1977-1978

SELF SOCIAL CONSTRUCTS TEST, 1977-1978

Subject	Self-Esteem			Social Distance from Students			Social Distance from Teachers			Attachment to Peers		
	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change[a]	Post-test Score	Pre-test Score	Pre-Post Change[a]	Post-test Score	Pre-test Score	Pre-Post Change
Site I												
103	27	30	- 3	5	5	0	8	8	0	10	19	- 9
104	27	28	- 1	2	2	0	2	2	0	22	12	+10
107	31	13	+18	2	4	- 2	2	8	- 6	15	12	+ 3
Site II												
201	28	43	-15	3	2	+ 1	7	6	+ 1	13	18	- 5
204	25	25	0	4	7	- 3	6	3	+ 3	3	3	0
207	43	48	- 5	12	7	+ 5	12	12	0	24	24	0
208	25	41	-16	2	2	0	2	2	0	24	24	0
210	32	28	+ 4	2	12	-10	12	12	0	24	24	0
212	23	33	-10	3	6	- 3	8	12	- 4	4	9	- 5
213	30	39	- 9	2	4	- 2	12	12	0	18	12	+ 6
215	22	30	- 8	2	7	- 5	2	2	0	21	24	- 3
216	35	26	+ 9	2	5	- 3	9	4	+ 5	21	21	0
217	28	17	+11	2	3	- 1	7	3	+ 4	12	13	- 1
Means	30	31	- 1.9	3	5	- 1.8	7	7	+ 0.2	16	16	- 0.3
Range	(0-48)			(2-12)			(2-12)			(0-24)		

[a]Negative changes are representative of *decreased* social distance (i.e., favorable change).

SELF-OBSERVATION SCALES, 1977-1978[a]

Subject	Self-Acceptance			Social Maturity			School Affiliation			Self-Security		
	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change	Post-test Score	Pre-test Score	Pre-Post Change
Site I												
103	59	57	+ 2	57	54	+ 3	57	35	+22	68	68	0
104	63	60	+ 3	62	60	+ 2	53	53	0	67	67	0
107	46	63	-17	21	44	-23	33	49	-16	33	58	-25
Site II												
201	61	60	+ 1	64	64	0	57	57	0	64	62	+ 2
204	50	52	- 2	40	30	+10	55	54	+ 1	48	49	- 1
207	61	60	+ 1	54	54	0	52	55	- 3	62	61	+ 1
208	53	59	- 6	52	54	+ 2	55	60	- 5	61	59	+ 2
210	59	53	+ 6	61	63	- 2	54	53	+ 1	64	54	+10
212	54	53	+ 1	33	27	+ 6	31	41	-10	47	53	- 6
213	58	61	- 3	59	59	0	38	54	-16	52	67	-15
215	59	62	- 3	62	57	+ 5	54	60	- 6	57	61	- 4
216	60	55	+ 5	54	49	+ 5	40	28	+12	61	56	+ 5
217	52	49	+ 3	58	59	- 1	56	55	+ 1	36	46	-10
Means	56	57	- 0.7	52	52	+ 0.5	49	50	- 2.3	55	58	- 3.1

[a]T-scores: scales are standardized with $\bar{x} = 50$ and s.d. = 10.

(SSCT) showed a significant decrease, but school affiliation scores (SOS) also yielded a significant decrease.

Longitudinal repeated measured analyses essentially corroborate these conclusions. Results for the three self-oriented attitude measures appear in Tables 15 and 16 (upper half). Here it is evident that the strongest source of variation in attitude toward self is grade level, older students exhibiting more favorable self constructs across fairly different measurement methods. Only self acceptance (SOS) also manifests a main effect for pre-post change in a positive direction; in the absence of support from measures of related constructs, however, this outcome is not strongly compelling. Tables 16 (lower half) through 18 present summary tables for repeated measures analyses of socially-oriented measures. As expected, strongest effects for change over time as well as grade level are generated by the social maturity measure (again interpreted as reflecting maturation). School reflective measures, in contrast, show the following results. SSCT measures of peer contact tapping aspects of intimacy and extensiveness show that while closeness to teachers is unaffected by any independent factor, older students seem to have more extensive peer networks and to feel closer to other students during the school year. On the other hand, the SOS measures of school affiliation evidence a decrease over the school year, especially among younger students. These findings have led us to three conclusions. First, it would be desirable to locate or develop more sensitive and valid measures of self and social attitudes among handicapped students. Second, it is possible that the history of often-tested severely handicapped students engenders rather invariant failure expectations with attendant negative self images that are difficult to overcome; we were unable to observe positive changes in self and social constructs commensurate with strong gains in achievement and related visual skills. Finally, it seems particularly important to give special attention to the socioemotional climate for lower-grade visually impaired elementary school students.

Attrition analyses lend support to some of the conclusions drawn from longitudinal studies of socially-oriented attitude measures and weaken others. The first variable examined, social maturity (SOS),

Table 15

LONGITUDINAL STUDY OF SELF ATTITUDES

SELF-ESTEEM (SSCT)

Participation Year

Change	I		II	
	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	25.8	29.3	34.0	28.5
Post	25.8	36.5	29.2	31.5

Source	F	P
Participation Year	.67	n.s.
Change	.52	n.s.
Grade Level	2.40	13
Year X Change	1.4	n.s.
Year X Grade	6.15	.02
Change X Grade	3.98	.06

SELF-ACCEPTANCE (SOS)

Participation Year

Change	I		II	
	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	52.5	56.3	52.0	57.0
Post	53.2	58.8	55.8	59.9

Source	F	P
Participation Year	.23	n.s.
Change	3.51	.08
Grade Level	5.56	.03
Year X Change	.44	n.s.
Year X Grade	.002	n.s.
Change X Grade	.03	n.s.

Table 16

LONGITUDINAL STUDY OF SELF-SOCIAL ORIENTATION

SELF-SECURITY (SOS)

	Participation Year			
	I		II	
Change	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	50.8	55.5	42.0	62.1
Post	48.5	58.3	47.5	60.1

Source	F	P
Participation Year	.008	n.s.
Change	.36	n.s.
Grade Level	8.90	.008
Year X Change	.20	n.s.
Year X Grade	1.33	n.s.
Change X Grade	.12	n.s.

SOCIAL MATURITY (SOS)

	Participation Year			
	I		II	
Change	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	40.2	51.7	29.0	54.5
Post	38.5	55.8	34.8	57.5

Source	F	P
Participation Year	.64	n.s.
Change	5.07	.04
Grade Level	35.23	.001
Year X Change	1.56	n.s.
Year X Grade	2.24	.15
Change X Grade	.38	n.s.

Table 17

LONGITUDINAL STUDY OF ATTITUDES
TOWARD PEERS

SOCIAL DISTANCE FROM STUDENTS (SSCT)

	Participation Year			
	I		II	
Change	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	4.7	6.8	3.0	5.5
Post	6.0	3.7	3.0	4.4

Source	F	P
Participation Year	1.70	n.s.
Change	1.24	n.s.
Grade Level	.84	n.s.
Year X Change	.07	n.s.
Year X Grade	.99	n.s.
Change X Grade	4.49	.05

SCOPE OF PEER ATTACHMENT (SSCT)

	Participation Year			
	I		II	
Change	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	13.0	18.3	14.2	18.4
Post	12.5	22.2	12.5	17.5

Source	F	P
Participation Year	.10	n.s.
Change	.03	n.s.
Grade Level	4.94	.04
Year X Change	1.93	n.s.
Year X Grade	.29	n.s.
Change X Grade	1.47	n.s.

Table 18

LONGITUDINAL STUDY OF SCHOOL ORIENTATION

SCHOOL AFFILIATION (SOS)

	Participation Year			
	I		II	
Change	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	50.3	52.3	46.2	47.0
Post	41.7	52.2	38.5	45.0

Source	F	P
Participation Year	1.46	n.s.
Change	6.22	.02
Grade Level	1.46	n.s.
Year X Change	.02	n.s.
Year X Grade	.10	n.s.
Change X Grade	3.65	.07

SOCIAL DISTANCE FROM TEACHERS (SSCT)

	Participation Year			
	I		II	
Change	Grade Level		Grade Level	
	Lower	Higher	Lower	Higher
Pre	6.3	5.0	4.5	6.8
Post	5.7	6.0	5.3	4.3

Source	F	P
Participation Year	.23	n.s.
Change	.16	n.s.
Grade Level	.00	n.s.
Year X Change	.12	n.s.
Year X Grade	.23	n.s.
Change X Grade	.19	n.s.

showed no effect for group or for the interaction of group with rate of change. Interestingly, however, when scores of the attrition group were combined with scores from the participation group, the rate of change was no longer significant. Apparently those who disenrolled were not advancing along the social maturity scale as rapidly as their counterparts who remained in the project, although the difference only weakened the influence of rate of change instead of establishing a significant interaction term. The participation sample, then, included subjects whose assessed social maturity may have increased more rapidly than the overall rate among the subjects as a whole.

Similarly, when the school affiliation (SOS) variable was examined in this way, it too failed to yield a significant effect for rate of change, even though such change had been established in the longitudinal analysis. In this instance, the examination also generated an approximately significant group-by-rate interaction term ($F = 2.58$, $p = .13$), indicating that the attrition group became less disaffected with school during the year than did the participation group. Longitudinal analyses, then, may overestimate declines in school affiliation.

With respect to the two social distance measures (SSCT), inclusion of the attrition group in a participation year I analysis produced no change in outcomes; means remained stable and no effects appeared for group or group-by-rate interaction. Comparable findings came from the analysis of the peer attachment measure (SSCT), except that the effect for rate of change was much stronger when the attrition group was included in the first year sample. Longitudinal analyses, then, may overestimate social maturity and underestimate affiliative feelings about the school setting among ICTS students.

The last psychosocial function measure involved affect decoding and encoding. This assessment was introduced in the third year of the study on the hypothesis that social perception and social communication might be visually based skills that mediate interpersonal behavior for visually impaired students in somewhat the same way that visual symbolic capability mediates academic activity. If so, then it would be worthwhile to attempt to understand more about the self-social constructs of subjects by assessing hypothetically underlying skills. Table 19

presents within-year results for the Interperson Perception Test. As is evident, at pretest subjects performed poorly on the facial affect recognition task (IPPT), and no statistically significant overall gains in affect decoding were attained. In part the absence of recognition gains seemed due to the task stimuli. Although every effort had been made to improve the contrast in the standard stimulus photographs for the IPPT, subjects still had difficulty discriminating facial details. While novel test development lay beyond the scope of the project, results from the affect encoding task led us to believe that a better stimulus set would have produced better results.

With respect to affect encoding ("making a face" conventionally representative of a specified affect), ICTS subjects scored profoundly worse than matched fully sighted controls (Table 20). However, within a year their post-test scores compared favorably with the pretest scores of the controls; no significant differences remained between them. The significant differences of ICTS subjects ($T = 0$, $p < .01$) are apparent in their pre- and post-photos (Figures 3-7). Because reproduction is usually regarded as more difficult than recognition, we suspect that recognition scores are depressed due to an inadequate measurement method. We believe that affect decoding and encoding among partially sighted students is an area well worth further exploration, particularly in relation to development of social competence among the visually handicapped.

In summary, three years of evaluation data suggest that the ICTS had a strong and stable positive impact on the learning experiences of partially sighted elementary school students enrolled in the demonstration classrooms. Effects are most visible in reading and mathematics achievement, where students have closed the gap between their own and grade normal outcomes. The greatest need is for developing methods to enhance self and social constructs, perhaps by using the ICTS to facilitate interpersonal competence. Overall it was our conclusion that the ICTS can be used to maximize the learning opportunities of severely visually impaired students and to provide educational experiences comparable to those of the fully sighted.

Table 19

INTERPERSON PERCEPTION TEST, 1977-1978

Subject	Pre-test Score	Post-test Score	Pre-Post Change
Site I			
103	5	3	-2
104	10	10	0
107	7	3	-4
Site II			
201	17	9	-8
204	3	6	+3
207	5	7	+2
208	9	9	0
210	8	8	0
212	7	10	+3
213	10	10	0
215	14	11	-3
216	8	9	+1
217	16	10	-4
Means	9.2	8.1	-0.9
Range		(0-20)	

Table 20

FACIAL AFFECT PRODUCTION, 1977-1978

Subject (Site II)	Matched Control Score[a]	Pre-test	Post-test	Pre-test Distance from Control	Post-test Distance from Control	Pre-Post Change
201	5.7	2.6	10.6	-3.1	+4.9	+8.0
204	5.4	1.4	7.8	-4.0	+2.4	+6.4
207	9.7	4.3	6.4	-5.4	+3.3	+2.1
208	8.9	3.0	10.5	-5.9	+1.6	+7.5
210	5.6	2.8	8.4	-2.8	+2.8	+5.6
212	9.1	2.5	10.0	-6.6	+0.9	+7.5
213	5.1	1.5	11.0	-3.6	+5.9	+9.5
214	6.3	2.9	8.4	-3.4	+2.1	+5.5
215	7.4	3.3	8.8	-4.1	+1.4	+5.5
216	8.1	3.1	9.3	-5.0	+1.2	+6.2
217	9.2	2.7	11.5	-6.5	+2.3	+8.8
Means	7.3	2.7	9.3	-4.6	+2.6	+6.6

Range = 0-12

[a]Control subjects were administered the test only once.

Fig. 3 — Pre/post facial affect data for subject aged 6: pre-photo left, post-photo right

Neutral

Happiness

Sadness

Fear

Disgust

Anger

Surprise

Fig. 4 — Pre/post facial affect data for subject aged 7: pre-photo left, post-photo right

Neutral

Happiness

Sadness

Fear

Disgust

Anger

Surprise

Fig. 5 — Pre/post facial affect data for subject aged 9: pre-photo left, post-photo right

Fig. 6 — Pre/post facial affect data for subject aged 10: pre-photo left, post-photo right

Neutral

Happiness

Sadness

Fear

Disgust

Anger

Surprise

Fig. 7 — Pre/post facial affect data for subject aged 12: pre-photo left, post-photo right

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